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February 5, 1991

United States Environmental Protection Agency
Region IV
345 Courtland Street, N.E.
Atlanta, Georgia 30365

Attention: Mr. Jon Bornholm

Re: Cost Comparison of Remedial Alternatives
Medley Farm Site
SEC Project No. G-8026.20

Dear Jon:

Per your request, attached is a comparison of estimated present worth costs for soil vapor extraction and natural flushing at the Medley Farm Site. The document had previously been faxed to your attention. Please feel free to call me if you have any questions or require additional information.

Regards,

Jim Cloonan

/Attachments

cc: Ms. Mary Jane Norville
Ms. Nancy Peterson
Mr. Ted Valerio
Mr. Phil Conner
Mr. Jim Chamness
Project File

COST COMPARISON OF SOIL VAPOR EXTRACTION WITH NATURAL FLUSHING

MEDLEY FARM SITE

FEBRUARY 4, 1991

SEC PROJECT NO. G-8026.20

SIRRINE ENVIRONMENTAL CONSULTANTS, INC.
GREENVILLE, SOUTH CAROLINA

INTRODUCTION

Soils at the Medley Farm Site (Site) pose no significant risks to human health or the environment under current conditions. Potential risks are only associated with groundwater that has been impacted by the leaching of volatile organic compounds (VOCs) from certain areas of soils. Infiltration will naturally flush VOCs into groundwater (Alternative SC-1). VOCs in groundwater would be recovered using extraction wells and treated prior to discharge (Alternative GWC-2A). The removal of VOCs from Site soils could be accelerated through soil vapor extraction (SVE; Alternative SC-3). The efficacy of SVE depends on whether it would be cost effective as compared to pump-and-treat alone (i.e., natural flushing).

The cost-effectiveness of SVE can best be evaluated by comparing its present worth costs with the additional groundwater remediation costs associated with natural flushing. Unsaturated transport modeling can be used to predict the time required for natural flushing to remediate site soils. A batch flushing model can be used to estimate the groundwater remediation period following SVE and natural flushing. The difference in remediation periods represents the additional groundwater remediation costs that SVE must be compared against.

DURATION OF ACTIVITIES

Existing Groundwater: A batch-flushing model (EPA, 1988) was used to estimate the time required to achieve MCLs under current groundwater conditions. Based on a 99.8 percent reduction of total VOCs in groundwater, remediation of Site groundwater is projected to take approximately 10 years assuming no flushing of additional contaminants into the groundwater. This time estimate is probably low, as actual groundwater remediation typically requires considerably longer than predicted by modelling (EPA, 1989). A protracted groundwater extraction period would reduce any time and cost savings associated with SVE.

Soil Vapor Extraction: Remediation of Site soils to the remediation levels given in the FS would require approximately one year. SVE would be conducted concurrently with groundwater extraction.

Natural Flushing: Based on maximum Site concentrations, adsorption to soils, and MCL value, trichlorethene would determine the duration of natural flushing. The leaching potential of TCE can be estimated using the unsaturated transport model presented in the FS (Appendix D). Based on maximum soil concentrations at the Site, TCE is projected to impact groundwater above MCLs for approximately 20 years (see attached table). Therefore, the time estimate projected for groundwater remediation assuming natural flushing would be approximately 20 years.

Final Groundwater Extraction: Groundwater extraction would be required following completion of natural flushing to remove residual levels of VOCs. VOC levels after 20 years would be approximately at MCL levels (attached table), considerably lower than for current conditions. It is assumed that a 50 percent reduction in VOCs would be required following the completion of natural flushing to obtain MCLs. Using the batch flushing model, final groundwater extraction would require approximately one year.

SVE would be completed within the 10 year estimate for groundwater remediation under current conditions. VOC levels remaining after SVE could not impact groundwater above MCLs. No further groundwater extraction past 10 years would be anticipated if the remediation is accomplished as predicted by the batch - flushing model.

Summary: Natural flushing is projected to result in approximately 11 more years of groundwater extraction than if SVE were conducted. Since a minimum of 10 years of groundwater extraction would be required based on current conditions, the costs for additional groundwater extraction would not begin until year 10. Experience with

groundwater remediation at Superfund sites indicates that the 10-year projection for groundwater extraction is likely a minimum. The difference in groundwater extraction periods between SVE and natural flushing is therefore likely to be an overestimate.

COST EVALUATION

The total present worth costs for SVE (Alternative SC-3) and annual groundwater remediation (Alternative GWC-2A) were estimated in the FS to be:

- SVE: $620,000
- Annual groundwater remediation costs: $86,000

The present worth costs for SVE must be compared with the present worth costs for the annualized series of groundwater remediation costs for the additional 11 years of operation. Calculation of the present worth costs for the additional groundwater remediation is a two step process:

- Convert the annual series to one cost at year 10.
- Convert the cost at year 10 to a present worth basis (year 0).

Present worth costs are evaluated at a discount rate of 5 percent, per EPA guidance. The calculation is:

Present worth cost	=	$86,000 (P/A, 11, 5%)(P/F, 10, 5%)
	=	$86,000 (8.306)(0.6139)
	=	$440,000

COST EFFECTIVENESS DETERMINATION

The present worth costs for soil vapor extraction would be approximately $620,000. The present worth costs to conduct an additional 11 years of groundwater remediation 10 years in the future, as required for natural flushing, would be approximately $440,000. Natural

flushing (Alternative SC-1) is therefore a more cost effective source control remedy for the Medley Farm Site than soil vapor extraction (Alternative SC-3). The estimated difference in present worth costs of approximately $180,000 is probably low since groundwater extraction at the Site will likely require more than the estimated 10 years to achieve MCLs.

REFERENCES

EPA, Guidance on Remedial Actions for Groundwater at Superfund Sites, EPA/540/G-88/003, Washington, DC, December 1988.

EPA, "Evaluation of Groundwater Extraction Remedies", EPA/504/0289/054, Washington, DC, 1989.

TABLE D.4

ESTIMATED SUBSURFACE SOIL REMEDIATION LEVEL
MEDLEY FARM SITE
COMPOUND - TRICHLOROETHENE

Qp =	900 gal/day	Qgw =	1500 gal/day
I =	0.305 m/yr	D =	15 meters
Koc =	126	d =	6 meters
R =	12.97	foc =	0.01
1/T =	0.007838	Kd =	1.26 l/kg
Vol. moist. content =	0.2	MCL =	5 ug/l
Bulk density =	1.9		

Time (years)	C/Co	Cs (ug/kg)	Cw (ug/l)	Cgw (ug/l)
0	0	12000	0.0	0.00
1	0.007807	11745	74.4	27.89
2	0.015554	11246	145.0	54.37
3	0.023241	10530	207.4	77.79
4	0.030867	9636	258.0	96.74
5	0.038434	8613	293.9	110.22
6	0.045942	7515	314.0	117.76
7	0.053392	6398	318.5	119.42
8	0.060783	5311	308.7	115.75
9	0.068116	4296	287.1	107.68
10	0.075392	3384	257.1	96.40
11	0.082611	2594	221.9	83.21
12	0.089774	1933	184.8	69.30
13	0.096881	1399	148.6	55.73
14	0.103933	983	115.4	43.28
15	0.110929	670	86.6	32.46
16	0.117871	442	62.7	23.51
17	0.124759	283	43.8	16.43
18	0.131593	175	29.5	11.07
19	0.138373	104	19.2	7.19
20	0.145101	60	12.0	4.50